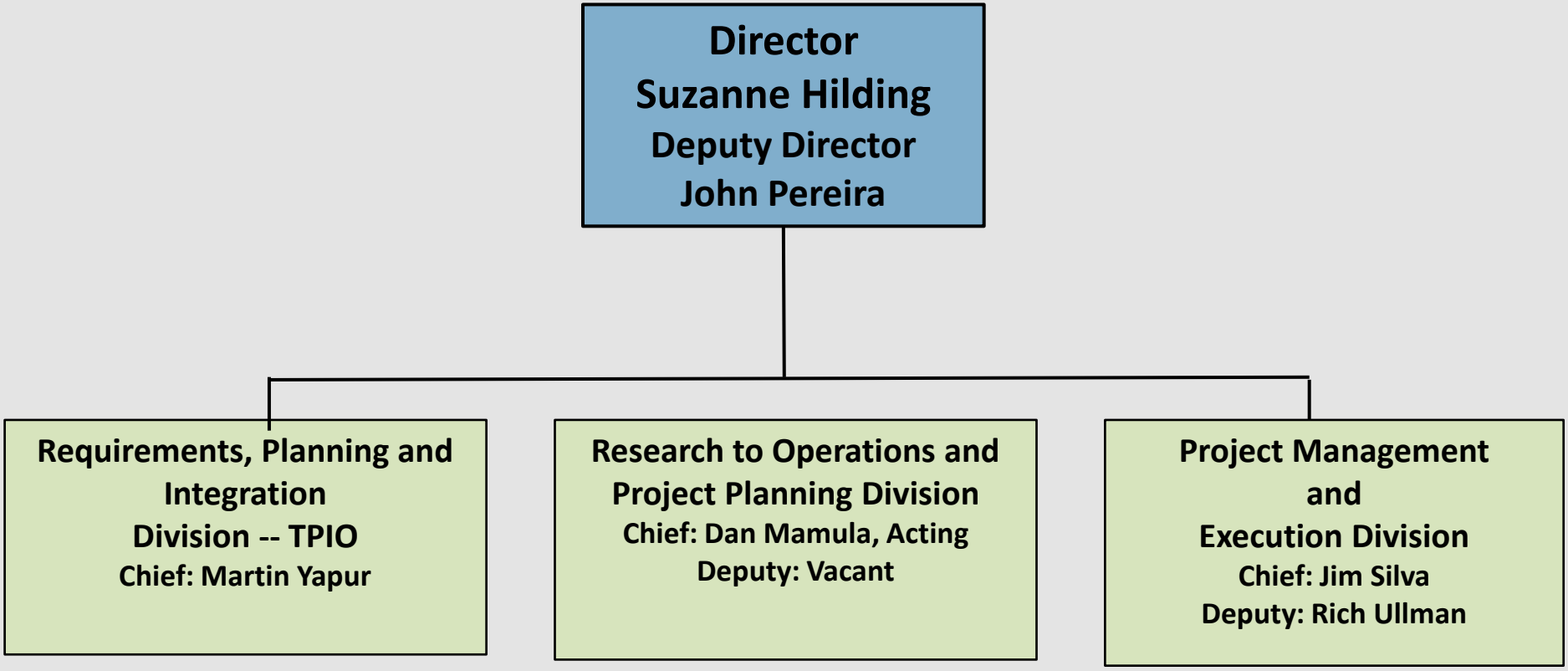
Office of Projects, Planning, and Analysis (OPPA)

John Pereira, Deputy Director

March 3, 2016

Office of Projects, Planning, and Analysis

SSMC1, 335 East West Highway, Silver Spring, MD



Roles and Responsibilities

- **Requirements, Planning and Integration Division - TPIO**
  - Provides comprehensive assessments for integration, optimization and sustainment of NOAA's Observing System Portfolio Management capability

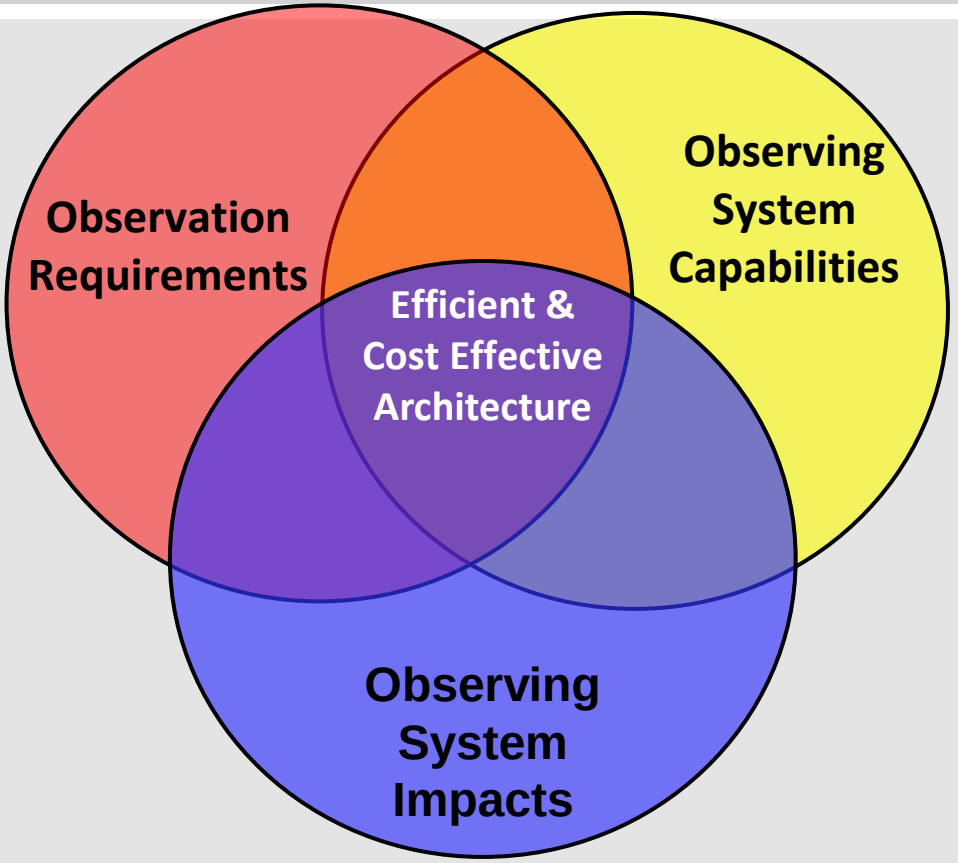
- **Research to Operations and Project Planning Division - ROPPD**
  - Defines system concept and performance objectives and specifications, based on requirements, for implementation by the current or future environmental satellite projects

- **Project Management and Execution Division - PMED**
  - Conducts planning, system studies, system acquisition, design, integration, and evaluation of operational environmental satellite projects

Requirements, Planning and Integration Division – TPIO

NOAA's Observing System Portfolio Management Capability:

- **Observing Requirements (System Independent)**
  - Consolidated Observation User Requirements List (COURL)
- **Observing Systems and Capabilities**
  - NOAA Observing System Architecture (NOSA)
- **Data Source Impact to Mission Services**
  - NOAA Observing System Integrated Analysis (NOSIA-II)



NOAA is driving toward *an enterprise observing architecture* that addresses: mission priorities; is flexible and responsive to assess and incorporate evolving technology opportunities; and economically sustainable.

Observing System Architecture

Total NOAA Observation Requirements = 1518

Observing System Owner	Location of Observing Systems				
	Terrestrial	Marine	Atmosphere	Space	Total
NOAA	42	50	12	7	111
U.S. Federal	36	6	13	21	76
State and Local	11	10	0	0	21
Academia	7	1	0	0	8
Commercial	1	3	0	3	7
International	10	9	3	12	34

Technology Planning and Integration for Observations (TPIO)
NOAA Observing System Integrated Analysis (NOSIA)

NOAA & Mission Goal Overall Status-Quo Performance Levels

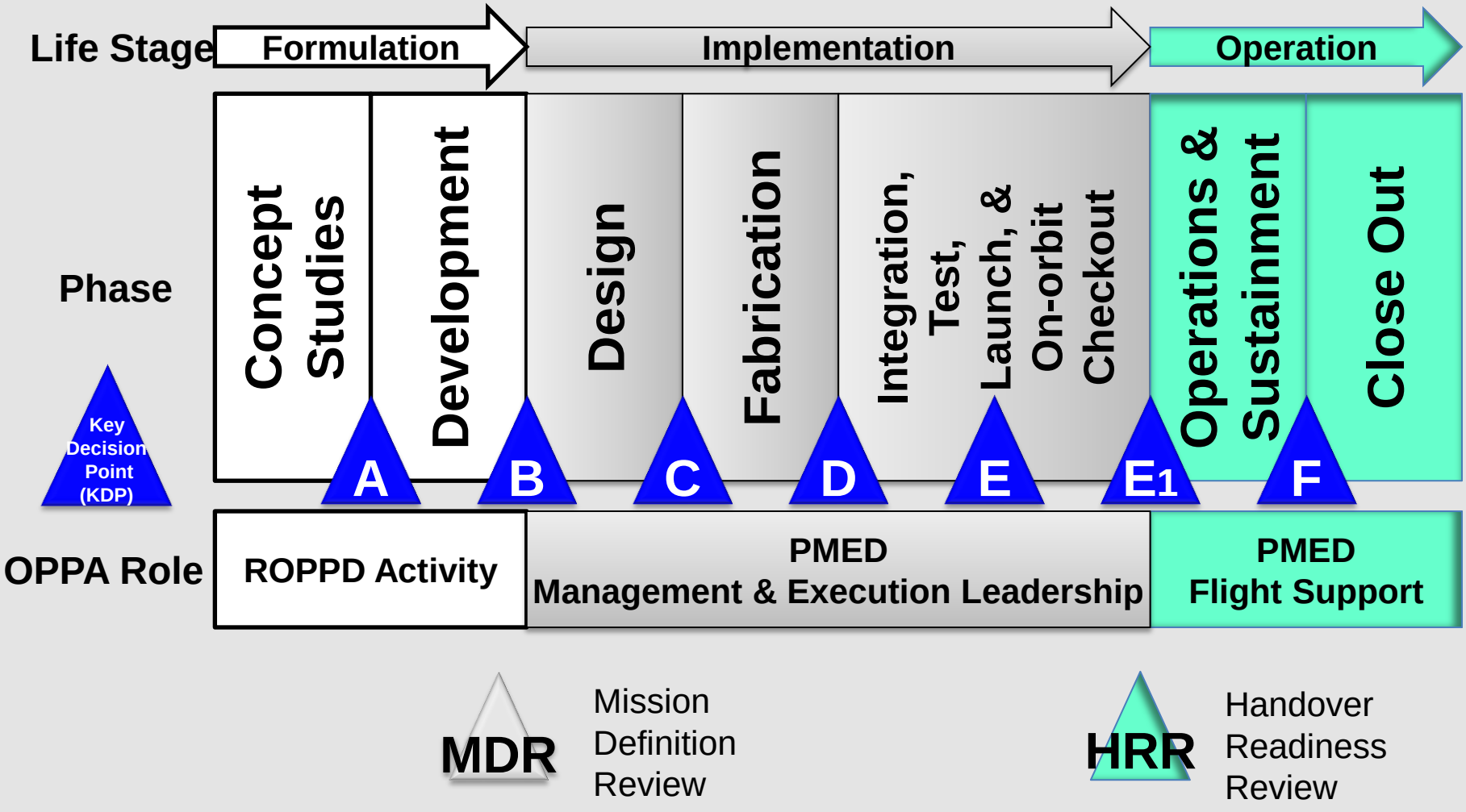
NOSIA-II is an analytical capability which enables assessments which guide observing system portfolio investments with the primary focus on outcomes.

- NOSIA-II capability incorporates organizational priorities within missions, observing system cost and capabilities, and the impact of information on the quality of NOAA's products and services.
- NOSIA-II potential users include NOAA Leadership, Line Office Portfolio Managers, Program Managers and architecture planners.

NOAA	**66**
Weather-Ready Nation	**74**
Resilient Coastal Communities and Economies	**70**
Climate Adaptation & Mitigation	**69**
Healthy Oceans	**53**

Performance (Satisfaction) Scale		
100	**Ideal**	Meets all requirements and exceeds some
90	**Fully Satisfied**	Meets all requirements
80	**Good**	Meets all major requirements, with minor limitations
60	**Fair**	Meets most major requirements, with significant limitations
40	**Poor**	Fails to meet many major requirements, but provides some value
20	**Very Poor**	Fails to meet most major requirements, but provides minor value
1	**No Capability**	Provides no value

Flight Program Life Stages, Phases, Key Decision Points, and OPPA Roles

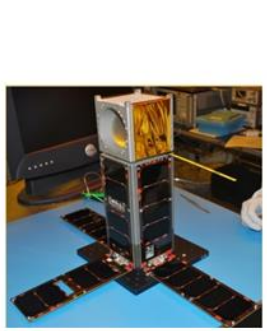


ROPPD Studies

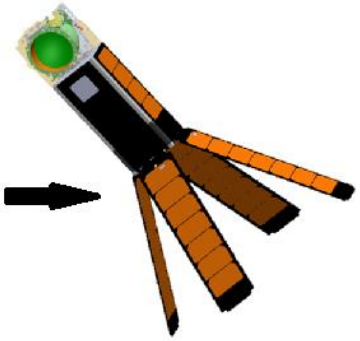
- MIT / LL CubeSat Design Studies
  - Risk assessment of payload and bus components for miniaturized microwave sounder
- JPL Sensor Studies
  - MidWave IR Sounder design and capabilities assessment versus a fully capable CriS – assessment of ability to meet NOAA sounder requirements
- OSSE Studies (CIMSS, JCSDA, and AOML)
  - Test the impact of “U-Class” global sounder measurements on NWP models
- Space Weather Follow-on Studies
  - Design of coronagraph components needed to sustain CME observations
  - Analysis of alternatives for future plasma / solar wind measurements
- Doppler Wind Lidar Outreach and Partnerships
  - Semi-annual meeting of the Working Group on Space-based Lidar Winds

EON-MW Overview

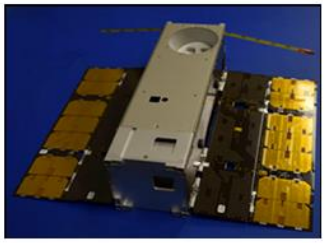
- Earth Observing Nanosatellite - Microwave (EON-MW): Miniaturized microwave sounder technology demonstration developed by MIT Lincoln Laboratory (MIT/LL)
- EON uses innovative, proven CubeSat technology to greatly reduce cost of construction and launch compared to traditional space systems
- EON is next evolutionary step in MIT/LL's CubeSat microwave sounder series



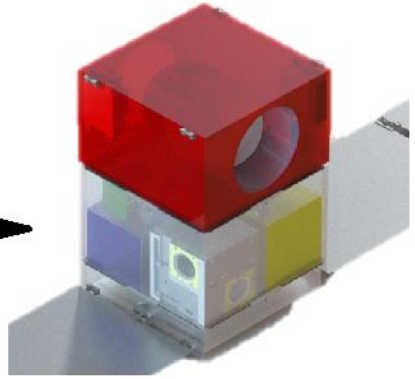
MicroMAS (2015)



MicroMAS-2 (2017)



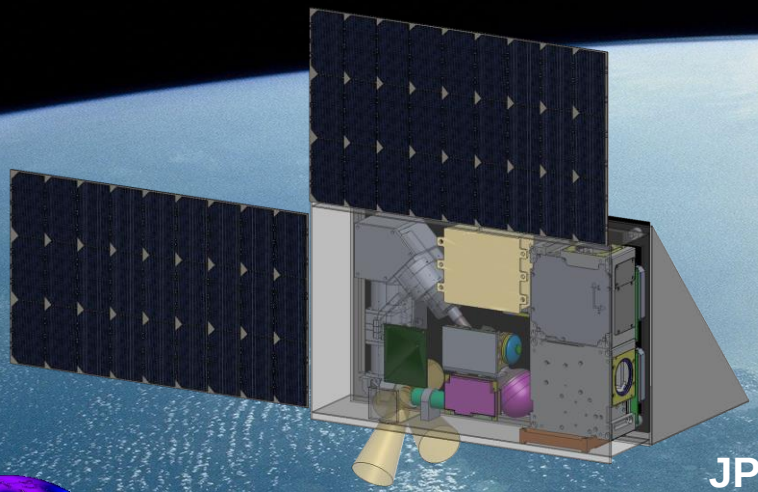
MiRaTA (2017)

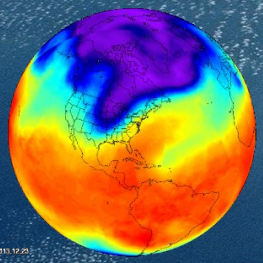


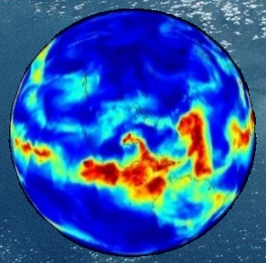
EON-MW (2020)

- Goal is to be operationally equivalent to 4-band, 22-channel ATMS on S-NPP
- Low cost polar-orbit microwave sounding gap mitigation. Could lead to low cost source of operational microwave soundings after JPSS Program

An Instrument Concept Study for an Advanced Imager-Sounder: Final Design Review







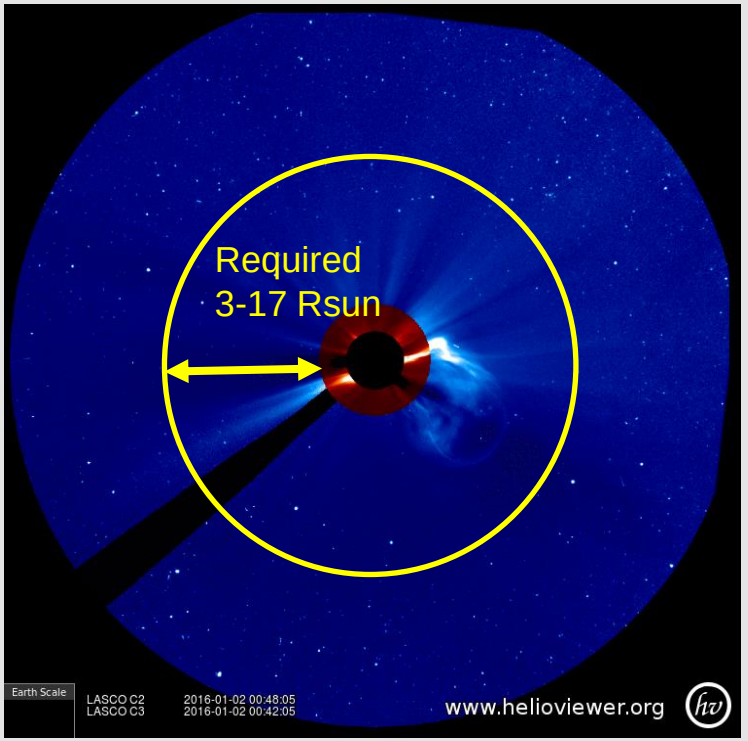
JPL Task Manager: Thomas S. Pagano
NOAA COTR: David Furlong

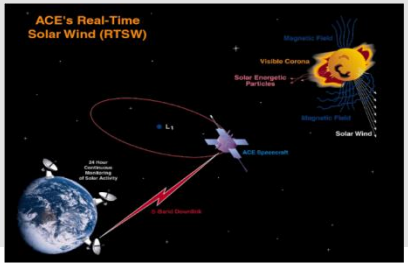
Jet Propulsion Laboratory,
California Institute of Technology, CA, USA

February 25, 2016

Space Weather Follow-On Overview

- Fulfill long term continuity of space weather requirements of solar wind measurements at L1 as well as images of coronal mass ejections from solar atmosphere (potential 2022 launch)
- Sun – Earth line (L1) coronagraph images presently from SOHO (critical potential gap) – input to heliospheric propagation code





SOHO Data

Heritage:
ACE, DSCOVR

Observing System Simulation Experiments (OSSEs)

Motivation for Performing OSSEs

- Costs of developing, maintaining & using new space-based observing systems typically exceed $100-500M / instrument
- Significant time lags between instrument deployment and eventual operational NWP use
- OSSEs can provide quantitative information on observing system impacts
  - New instruments
  - Alternative mix of current instruments
  - Data assimilation system diagnosis and improvement
- Information from OSSEs can lead to better planning and decisions

OSSE Objectives:

1. To provide a *QUANTITATIVE* assessment of the potential impact of proposed observing systems on data assimilation, and numerical prediction.
2. To evaluate and/or develop new methodology for the processing and assimilation of new types of data.
3. To evaluate tradeoffs in the design and configuration of proposed observing systems (e.g. coverage, resolution, accuracy and data redundancy).
4. To optimize the global observing system for weather, climate or other mission goal.

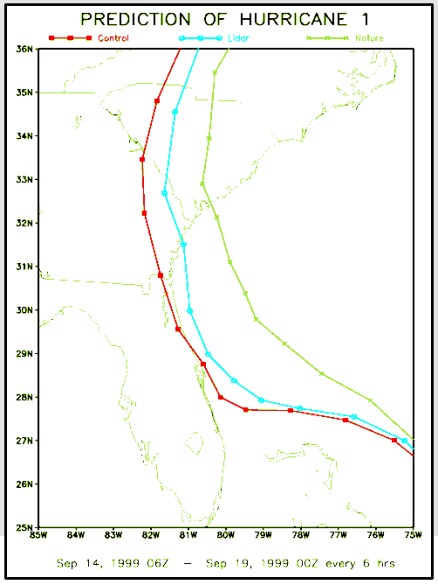
OSSE Example:
Simulated Doppler Wind Lidar Impact on a Hurricane Track Forecast

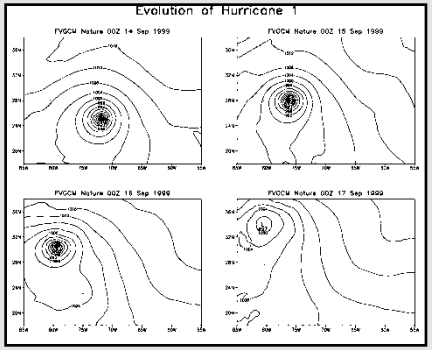
Green: Actual track

Red: Forecast beginning 63 hours before landfall with current data

Blue: Improved forecast for same time period with simulated DWL data

Note:
A significant positive impact was obtained for both of the land falling hurricanes in that year's data; the average impact for 43 oceanic tropical cyclone verifications was also significantly positive.





[Robert Atlas et al., NOAA/AOML]

Doppler Wind Lidar (DWL)

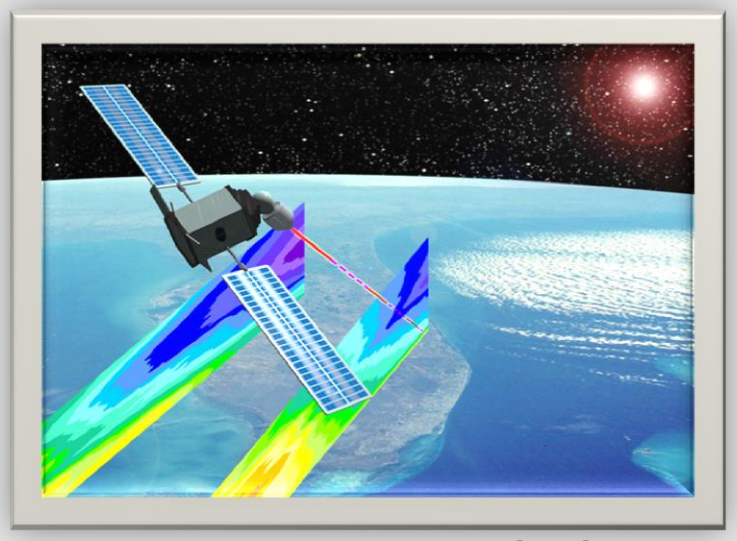
Independent modeling studies at NOAA/NCEP, NOAA/ESRL, NASA and the European ECMWF show **tropospheric wind profiles** to be the **single most beneficial measurement <u>now absent</u> from the Global Observing System**.

Global Wind Profiles are NOAA's # 1 Unmet observational need for its **meteorological NWP mission**. Global Wind Profiles would support achieving NOAA's strategic goals of a Weather Ready Nation and Understanding Climate Variability and Change.

Space-based **Doppler Wind Lidar [DWL] observations** can provide measurements of **Global Wind Profiles** in the troposphere and lower stratosphere.

The first **National Research Council (NRC) Decadal Survey** report for Earth Sciences and Applications from Space recommended **a global wind mission**.

The NRC Weather Panel determined that a **hybrid Doppler Wind Lidar (DWL)** in low Earth orbit could make a **transformational** impact on global tropospheric wind analyses and NWP.



Notional Doppler Wind Lidar [DWL]

DWL Observations / Measurements

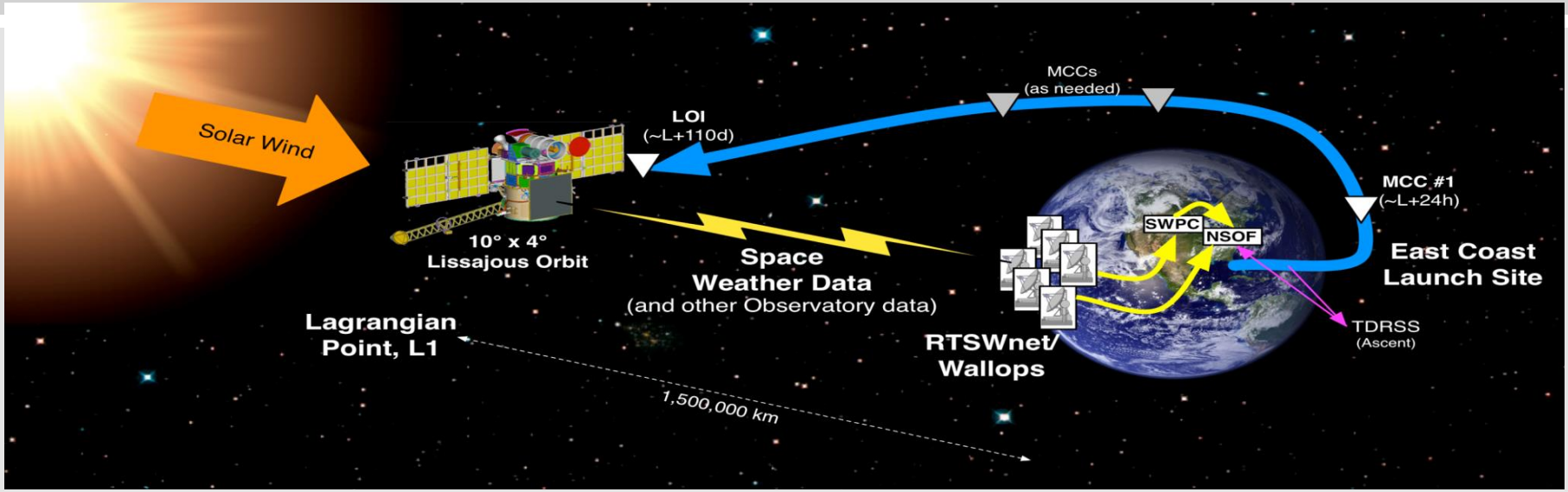
Wind profile observations (speed and direction as a function of height) in the earth's troposphere using lidar backscatter measurements from aerosols in the earth's atmosphere.

Wind profile observations (speed and direction as a function of height) in the earth's upper troposphere and lower stratosphere using lidar backscatter measurements from molecules in the earth's atmosphere.

Program Management and Execution Division (PMED)

- Mission
  - Responsible for managing OPPA projects and partnerships in the implementation and operations phases of the NESDIS satellite acquisition process.
  - Uses project engineering lifecycle methods including entry and exit points (KDP's). The PMED Role differs in the three broad stages of a program life: Formulation, Implementation, and Operation. (See next slide)
  - Develops formal acquisition processes; e.g., Satellite Acquisition Process, Management partnership roles; and Management Control Plan for Projects in Execution

DSCOVR Mission Overview



Mission Objectives

- Primary operations objective of the DSCOVR mission is to provide solar wind thermal plasma and magnetic field measurements to enable space weather forecasting by NOAA
- Secondary science objectives are to image the Sun lit disk of Earth in 10 spectral bands with a spatial resolution of 12 km or better, to determine ozone, aerosol, cloud cover, cloud height, vegetation, and leaf area indices and to measure the Earth reflected irradiance in the wavelength range of 0.2 - 100 microns

Category II, Risk Class D

Mission Overview

- Launched: February 11, 2015
- Launch Vehicle: Falcon-9
- Small Explorer Spacecraft Bus
- Design life of 2 years (goal of 5 years)
- L1 Orbit, ~1.5 million kilometers from earth

Instruments

- Plasma –Magnetometer (PlasMag): Magnetometer and Faraday Cup
- Electron Spectrometer
- Earth Polychromatic Imaging Camera (EPIC)
- NIST Advanced Radiometer (NISTAR)
- Pulse Height Analyzer (PHA)

NOAA funded items in BLUE

Jason-3 Mission Overview

Science Measurements

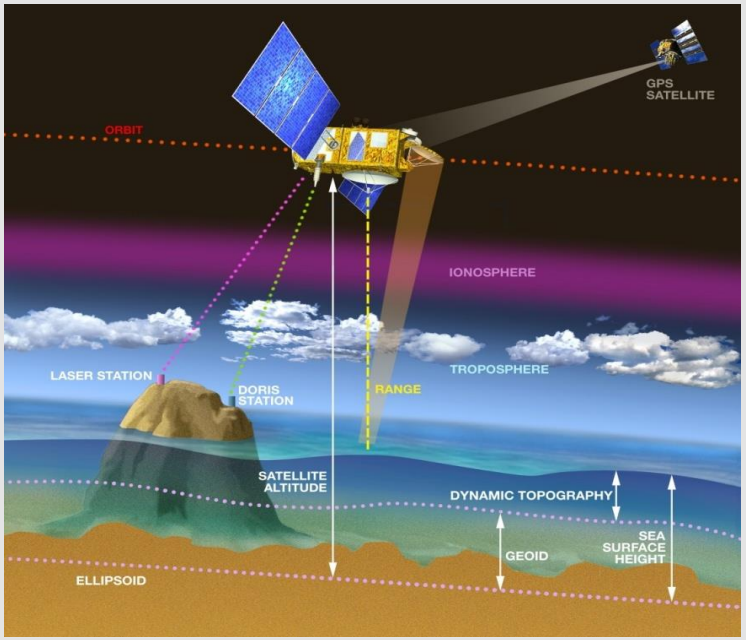
Global sea surface height to an accuracy of ≤ 4 cm every 10 days, for determining ocean circulation, climate change and sea level rise

Mission Objectives

- **Operational ocean altimetry mission to enable the continuation of multi-decadal ocean topography measurements achieved through TOPEX/Poseidon, Jason-1 and OSTM/Jason-2**
- **NOAA and EUMETSAT are lead agencies with CNES and NASA/JPL providing implementation support**

Instruments

- **Core Mission:**
  - **Poseidon-3B Altimeter**
  - **DORIS (Precise Orbit Determination System)**
  - **Advanced Microwave Radiometer (AMR)**
  - **GPS Payload (GPSP)**
  - **Laser Retro-reflector Array (LRA)**
- **Passengers (Experiments):**
  - **JRE (Carmen3 + LPT)**



Mission Overview

- **Launched: January 17, 2016**
- **Launch Vehicle: Falcon-9.1**
- **Proteus Spacecraft Bus provided by CNES**
- **Mission life of 3 years (goal of 5 years)**
- **1336 km Orbit, 66º Inclination**

NOAA funded items in BLUE

COSMIC-2 Mission Overview

Mission Objectives

- Follow-on to current COSMIC-1 satellite constellation
- Design concept meets L1RD requirements
  - System will provide 10,000+ worldwide soundings per day
  - All weather, uniform coverage over oceans and land with 30 min average latency
- 12 Satellite Constellation, 2 launches in different inclinations
  - 6 satellites to 24 degree orbit – carries USAF primary and secondary payloads
  - 6 satellites to 72 degree orbit – carries NOAA primary and Taiwan secondary payloads (planned)

Instruments

- First Launch:
  - TriG GNSS-RO receiver (TGRS)
  - Ion Velocity Meter (IVM)
  - RF Beacon
- Second Launch:
  - TriG GNSS-RO receiver (TGRS)
  - Taiwan-procured Scientific Payloads are TBD

Mission Overview

- Launch Dates:
  - C-2a: 1QCY2017
  - C-2b: 2018 (TBD)
- Launch Vehicle:
  - C-2a: Falcon Heavy [STP-2 Mission]
  - C-2b: TBD
- Design Life: 5 years
- Mission: 5 years (on orbit)
- Orbits:
  - C-2a: Equatorial; 24 degree inclination
  - C-2b: Polar; 72 degree inclination

MetOp Mission Overview

Science Measurements

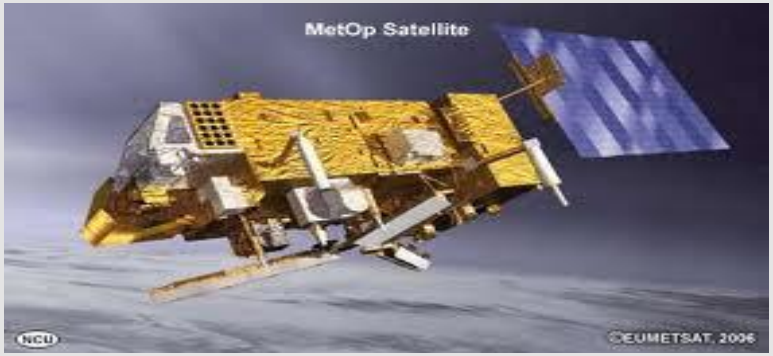
Atmospheric temperature profiles from microwave and IR sensors to improve weather forecasting, enhance local hazard warnings, and contribute to increased knowledge of climate change. Visible and IR imagery delivers accurate global and regional sea surface temperatures to assess evolution of El Nino and La Nina ocean phenomena

Mission Objectives

- **To become better stewards of the environment and reduce potential losses due to natural hazards**

Mission Overview

- **Launch Date: MetOp-A (Oct 2006), MetOp-B (Sep 2012), MetOp-C (Oct 2018)**
- **Launch Vehicle: Soyuz**
- **Spacecraft provided by EUMETSAT (Airbus)**
- **Mission life of 5 years (goal of 7 years)**
- **817 km Orbit, Sun-synchronous**



MetOp C Instruments

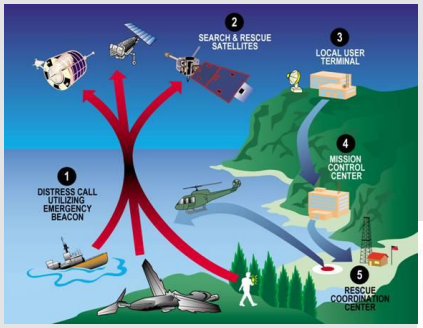
- **Advanced Microwave Radiometer (AMSU-A)**
- **Advanced Very High Resolution Radiometer (AVHRR)**
- **Space Environment Monitoring (SEM)**
- **IR Atmospheric Sounding Interferometer (IASI)**
- **GNSS Receiver for Atmospheric Soundings (GRAS)**
- **Global Ozone Measurement Experiment (GOME)**
- **Microwave Humidity Sounder (MHS)**
- **Advanced Data Collection System (ADCS)**
- **Advanced SCATerometer (ASCAT)**

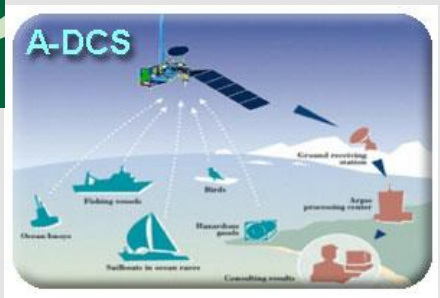
NOAA funded items in BLUE

CDARS Mission Overview

Mission Objectives

- Continue the operation of the SAR instruments as part of the international COSPAS-SARSAT system designed to detect and locate Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs) and Personal Locator Beacons (PLBs)
- Continue the operation of the Argos Data Collection System obtaining a wide variety of data from platforms used for both environmental study and non-environmental uses





Mission Overview

- Integrate A-DCS, SARR and SARP onto Commercially Hosted Payload, LRD: 2020
- Commercially Hosted Payload: USAF HoPS Contract
- Ground Support: HoPS contractor
- Mission Operations: HoPS Contractor

Instruments

- Search and Rescue Repeater (SARR), Canada/Com Dev
- Search and Rescue Processor (SARP), CNES / France / Thales
- Advanced Data Collection System (A-DCS), CNES / France / Thales

Contract Opportunities

- Acquisition Management Support
- Scientific and Technical Analysis support
- Project Management and Configuration Management Control
- Engineering Support
- Communications / Outreach
- Conference Planning
- Administrative Services

Thank you!